PATENT

"Express Mail" mailing label number EV 327 133 318 US

Date of Deposit October 14, 2003

Case No. 3591-1336

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR UNITED STATES LETTERS PATENT

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TITLE: **BACKREST FOR A SEATING STRUCTURE WITH AN ADJUSTABLE SACRAL SUPPORT**

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BACKREST FOR A SEATING STRUCTURE WITH AN ADJUSTABLE SACRAL SUPPORT

This application claims the benefit of U.S. Provisional Application Serial Number 60/418,483, filed October 15, 2002, the entire disclosure of which is hereby incorporated herein by reference.

BACKGROUND

The present invention relates generally to a backrest for a seating structure, and in particular, to a backrest having an adjustable sacral support.

The spine is broken down into four general regions: cervical (neck), thoracic (upper back), lumbar (lower back) and sacral/pelvic (tail bone). In some circumstances, back problems can be experienced at the point were the lumbar spine connects to the sacrum. In particular, sitting up straight can be difficult for the users of many chairs. For example, in many seating devices, a void exists between the backrest of the chair and sacrum of the user. As a result, the user will be placed in a position of poor posture, lack of muscle control and discomfort. Slouching can lead to a number of problems, including increased fatigue and fidgeting due to discomfort. In addition, slouching may also lead to increased pressure on the lumbar discs or muscle spasms. Long-term problems such as lower back pain, sore necks and the like can also occur.

In order to alleviate some of these problems, previous attempts have been made to provide better support for the sacrum. Some of these devices, however, as disclosed for example in U.S. Patent No. 5,577,811, are not readily adjustable to suit the individual needs of the user. Others, while adjustable, are relatively complex and expensive to manufacture. Accordingly, a need remains for an improved, simple sacral/pelvic support that is readily adjustable.

SUMMARY

The present inventions are defined by the claims, and nothing in this section should be read as a limitation on those claims. Rather, by way of general introduction and briefly stated, various preferred embodiments are described that relate to a seating structure having a backrest with an adjustable sacral support.

In one preferred embodiment, a back member has an upper and lower region and a frame member. A sacral support member has at least one end connected to one of the frame member and the back member and an opposite free end. The sacral support member supports the back member at the lower region thereof. A fulcrum member is moveably disposed between a portion of the sacral support member and one of the frame member and the back member. The fulcrum member is moveable toward and away from the free end of the sacral support member.

In one preferred embodiment, the sacral support has a portion supported by a lumbar support member, which supports the back member above the sacral support.

In another aspect, a method for adjusting a backrest includes engaging a lower region of a back member with a sacral support member having a free end and a cantilevered length, engaging the sacral support member with a fulcrum member, and moving the fulcrum member toward and away from the free end of the sacral support member so as to thereby shorten and length the cantilevered length of the sacral support member.

The various preferred embodiments provide significant advantages over other seating structure having sacral supports. In particular, the sacral support can be easily and quickly adjusted simply by moving the fulcrum member to the desired position. The relatively few and inexpensive parts provide improved support for the user's sacrum in a simple and efficient manner.

The present invention, together with further objects and advantages, will be best understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view of one embodiment of a chair having a backrest.

FIGURE 2 is an exploded perspective view of a backrest assembly.

FIGURE 3 is a side view of a back support member.

FIGURE 4 is a cross-sectional view of the back support member taken along line 4-4 of Figure 3.

FIGURE 5 is a front view of a back support member.

FIGURE 6 is a cross-sectional view of the back support member taken along line 6-6 of Figure 5.

FIGURE 7 is a side view of a back support fulcrum member.

FIGURE 8 is a partial top view of the back support fulcrum member shown in Figure 7.

FIGURE 9 is front view of a back member with a cut-out therein.

FIGURE 10 is a front view of the back member shown in Figure 9 with a hinge portion overmolded thereon.

FIGURE 11 is a partial cross-sectional view of the back member taken along line 11-11 of Figure 10.

FIGURE 12 is a rear perspective view of one embodiment of a backrest.

FIGURE 13 is a cross-sectional view of the backrest spine.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

The terms "longitudinal" and "lateral" as used herein are intended to indicate the direction of the chair from front to back and from side to side, respectively. Similarly, the terms "front", "side", "back", "forwardly",

"rearwardly", "upwardly" and "downwardly" as used herein are intended to indicate the various directions and portions of the chair as normally understood when viewed from the perspective of a user sitting in the chair.

Referring to the drawings, FIG. 1 shows one embodiment of a chair having tilt control housing **10**, seat **200**, back support **304** and back **302**. It should be understood that the term "housing" generally refers to any support member that supports another member, and includes, but is not limited to a structure that provides an enclosure. A pair of armrests **400** extends from, move with and define a portion of the back support **304**. Preferably, the back support **304** is pivotally mounted to the control housing **10**, and the seat **200** is pivotally mounted to the back support **304** via a pivot axis located on the armrests **400** at the approximate hip joint of the user above the seating surface. The seat **200** is further slideably and pivotally supported by the tilt control housing.

It should be understood that the terms "mounted," "connected", "coupled," "supported by," and variations thereof, refer to two or more members or components that are joined, engaged or abutted, whether directly or indirectly, for example, by way of another component or member, and further that the two or more members, or intervening member(s) can be joined by being integrally formed, or by way of various fastening devices, including for example and without limitation, mechanical fasteners, adhesives, welding, press fit, bent-over tab members, etc.

In operation, the housing **10**, seat **200** and back support **304**, with the armrests **400**, form a three-bar linkage with a slide. It should be understood that the term "slide," as used herein, refers to two members that translate relative to each other, whether by direct sliding or by rolling. Preferably, the pivot axis formed between the seat **200** and housing **10** is positioned forwardly of the pivot axis formed between the back support **304** and housing **10**, which axis is positioned forwardly of the pivot axis formed between the back support **304** and the seat **200**, such that the backrest **300** and back support **304**

tilt rearwardly at a greater rate and angle than does the seat **200**. Preferably, the back tilts relative to the seat at about a preferred 2:1 ratio, such that the shirt-tail pull effect is avoided. Of course, other synchrotilt ratios are contemplated and suitable. In addition, the configuration of the back support, the seat and the various positions of the pivot axes, allow the seat to pivot about the ankles of a user seated in the chair, preferably without the front edge of the seat rising as the user tilts rearwardly. The three-bar linkage provides a simple and compact mechanism that avoids the use of additional links. Additionally, by forming the linkage assembly from the seat, back support and housing, complex and expensive links and load bearing parts are avoided.

Referring to FIG. 1, a base **26**, preferably a five arm base with casters, is mounted to the bottom of a support column **12**, which supports the housing, in a conventional manner, although one of skill in the art would understand that other support columns and bases can be used to support the housing, including fixed height support columns and non-rolling bases, including for example a base configured with glides.

Referring to FIGS. 1, 2 and 12, one embodiment of a backrest **300** includes a backrest frame member, or back support member **304**, and a back member **302**. The support member **304**, otherwise referred to as a frame member, includes a lower support member **308** having a pair of forwardly extending arms **310** that are pivotally connected to the tilt control housing **10**.

As shown in FIGS. 2 and 12, a rear portion of the lower support member forms an upwardly extending arm **322**. An upper support member **324**, or spine, has a lower end **326** that mates with and is secured to the arm **322** with a pair of fasteners **327**. A cover can be disposed over the fasteners to provide a smooth, aesthetic appearance. By making the support member **304** in two-pieces **308**, **324** the backrest can be disassembled and the chair can be shipped in a smaller package. In particular, the arm **322** of the lower backrest support preferably does not extend upwardly above the uppermost surface of the armrests, such that the base, seat and armrests can be

compressed to a relatively short height. In turn, the backrest **300** can be easily assembled by the end user with a pair of fasteners. Moreover, the backrest can be made offline, if desired. As shown in FIG. 2, the lower end **326** of the spine flares outwardly and defines a pair of opposite landings **328** that mate with the back member **302**.

The spine **324** extends upwardly and has a pair of arms **330** that extend upwardly and outwardly from an upper end thereof. The ends of the arms each have a pad **332** that is secured to the back member **302** with a fastener. In particular, as shown in FIGS. 2, a boss **303** extends from the rear of the back member and supports the pad and receives the fastener. A front surface of the spine has a rack, or a plurality of notches formed thereon. In one embodiment, the rack is formed on a lumbar support insert **820**, which is secured to the front side of the spine with a plurality of fasteners **822**. The lumbar support insert **820** and spine can be made of various materials, such as Capron 8233G – 33% Glass Filled Nylon 6, or other materials such as aluminum, steel, fiberglass, composites, plastic, or some other rigid but resilient material.

Referring to FIGS. 2 and 13, in one preferred embodiment, the spine **324** has a plurality of forwardly extending fins **821**, while the lumbar support insert **820** has a plurality of rearwardly extending fins **823** that are shaped to be inserted or nested in the spaces formed between the plurality of fins **821**. In this way, the spine and insert are very strong and resistant to bending, yet provide substantially torsional flexibility. In addition, the two pieces can be easily made from molded plastic, with thinner walls and less material. In addition, the insert **820** and spine **824** can be spaced apart along the sides thereof to form a gap.

Referring to FIGS. 2, 9 and 10, the back member **302** is preferably made of a resilient, compliant material, including various polymeric or plastic materials. For example, in one preferred embodiment, the back member is molded of a polypropylene 76523 Montel Profax material. The back

member **302** has a top **336**, a bottom **338** and opposite, curvilinear sides **340**. The sides **340** preferably have a concave, or hour-glass shape. The top **336** of the back member is preferably curved and has a convex front, body-supporting surface **342** along a peripheral portion thereof.

The back member has a lumbar region **344**, a thoracic region **346** and a lower sacral region **348**. The lower region includes a cut-out **350** shaped to be received on the lower end **326** of the spine, with a pair of bosses **352** positioned to mate with holes formed in the landings **328**. In one embodiment, the lower region has a sacral regions that is formed by a forwardly extending portion at the center of the lower region. A pair of fasteners secure the bottom of the back member **302** to the landings **328**. The back member **302** has a plurality of openings **354** formed therethrough. Preferably, an array of openings in the lumbar region **344** are elongated in the longitudinal direction, which runs between the top and the bottom of the back member. The openings **354** are preferably staggered. For example, in one preferred embodiment, adjacent vertical columns of openings are offset in the vertical direction, such that the openings in adjacent columns are not horizontally aligned.

As with the lumbar region **344**, the thoracic region **346** also includes an array of staggered elongated openings **354**. Preferably, the elongated openings formed in the thoracic region are not as elongated, on average, as the openings in the lumbar region. This means, of course, that an occasional opening, or plurality of openings, in the thoracic region can have a greater elongation than an opening or plurality of openings in the lumbar region.

Likewise, the lower region **348** has an array of staggered elongated openings **354** formed therein, again, with an average elongation less than that of the lumbar region. Referring to FIG. 2 and 9-10, in one embodiment, the elongated openings **355** in the lower region transition from a longitudinal orientation to a lateral orientation, with the transition being made progressively lower as it moves from a center line outboard, so as to form a

generally triangular region of lateral openings. Some of the openings are curved to make the transition.

The elongated openings in the lumbar region and the adjacent transition areas of the thoracic and lower regions are preferably obround **356**. The shapes of the openings then transition from the obround shape to a peanut-shaped opening **358** as the location thereof moves upwardly, and then eventually the peanut-shaped openings are closed at a middle thereof to form substantially circular openings **360** adjacent the top and bottom of the back member. In addition, smaller circular openings **362** are formed along the opposite sides of the back member, including at the lumbar region, and around the entire peripheral portion of the back member. In the embodiment of FIG. 2, the openings in the lower region do not transition to a peanut shape, but rather preferably stay obround, with an outer perimeter of circular openings **362**. Of course, it should be understood that the opening could so transition in the lower region, and can remain in a substantially vertical orientation, as shown for example in FIGS. 1 and 12.

The back member **302**, especially in the lumbar region, also preferably has a first thickness along the center line **364** thereof, and a second thickness at the peripheral sides **366** thereof, with the second thickness being greater than the first thickness. For example, in the lumbar region, one preferred first thickness is about 2 mm, and one preferred second thickness is about 3 mm. As shown in FIG. 2, the back member is preferably bowed forwardly at the lumbar region **344**. The edge of the back member preferably is formed as a bead. The back member is preferably formed by molding.

Referring to FIGS. 2-11, a second back support configuration includes a first support member **1300** and a second support member **1302**. In one preferred embodiment, the first support member **1300** is formed as a loop having a base **1304**, a pair of arms **1306** and a support band **1308** or belt extending between the two arms **1306**. The support band has a forwardly facing surface **1310** that engages and supports a rear surface of the back

member **302**. A downwardly opening recess **1312** or pocket is formed in the middle portion of the belt, as best shown in FIGS. 5 and 6. The recess **1312** forms a guide or track for a portion of the second support member **1302**.

As best shown in FIGS. 3 and 4, the second support member **1302** has a J-shape, with a base arm **1314** connected to a support arm **1316** having an end **1318**, which is shaped and configured to be received in the recess **1312** of the second support member. The bottom of the J-shaped support member **1302**, or a curved portion **1328** forms a free end of the support member **1302**. The end **1318** of the support arm is supported by the lumbar support **1300** as it slides vertically in the recess, so as to allow the first and second support members to function independently. At the same time, the loop supports the support arm **1316** laterally and in the fore/aft direction. Alternatively, the end **1318** of the support arm **1316** can remain unsupported, or it can be fixedly connected to the first support member, or lumbar support, or to the frame.

The base arm **1314** has an upper end **1320** disposed between the base of the first support member and the lumbar insert member. A fastener secures the first support member **1300** and the second support member **1302** to the insert member **820**. The arms **1314**, **1316** of the second support member, once installed, function as a cantilevered spring, which is supported at ends **1302** and **1318** and has free end **1328**. The base arm **1314** has a plurality of longitudinally extending and rearwardly facing grooves **1322**, **1324**, which define a plurality of ridges. The base arm **1314** also has a step **1326** formed at the bottom thereof, which is connected to the curved portion **1328** that transitions to the support arm **1316** and provides additional flexibility between the arms **1314** and **1316**. In this way, the overall support member **1302**, including both arms acting in concert, functions as a cantilevered spring, while the individual arms **1314**, **1316** act as individual springs that provide additional independent flexibility.

Referring to FIGS. 2, 7 and 8, a fulcrum member **1330** is disposed between the insert member **820** and the base arm **1314** of the second support

member. The fulcrum member includes a base portion **1344** forming a cavity **1348** that substantially surrounds and conforms to the forward surface of the insert member **820**. The base portion includes a plurality of hook members **824** that engage and slide along the sides **826** of the lumbar insert support member **820**. Preferably, the hook members extend through the gap **829** formed between the spine and the insert member. In one embodiment, the fulcrum member further includes a detent or latch member that engages the rack to releasably secure the fulcrum member in a plurality of vertical positions. Alternatively, or in combination, the fulcrum includes a guide member **1332** or ridge formed in the cavity **1348** that rides in a groove **1334** formed in the spine insert member. In one embodiment, the fulcrum member includes a pair of handles **1336**. The handles extend outwardly and downwardly and include a grippable portion **1338**, formed form example as a plurality of annular ridges, on the ends thereof. The front portion of the fulcrum member include a pair of guide members **1340** or tabs that ride in the outer channels **1322** formed in the base support arm. The fulcrum, first support member and second support member are preferably made of one or more types of plastic, such as nylon or glass-filled nylon, but can be made of other materials, such as metal, wood, composites, fiberglass and the like.

It should be understood that in an alternative embodiment, one or all of the sacral support member, the lumbar support member and the fulcrum member can be connected to the back member and engage the frame.

In operation, the user grips one or both of the fulcrum handles **1336** and moves the fulcrum in the vertical direction to a desired position. As the fulcrum is lowered, it shortens the cantilevered length of the support member **1302**, i.e., the distance between the fulcrum and the bottom curved portion **1328**, and the arms **1314**, **1316** in particular, and provides a firmer, more rigid support for the lower region **348** of the back member as it engages the rear surface thereof. The user can raise the fulcrum **1330** so as to provide a greater cantilevered length, which in turn provides more flexibility of the support

member and a corresponding less rigid support of the back member in the lower region.

Referring to FIGS. 9-11, the back member **302** can be modified to improve the flexibility of the lower region thereof. In particular, a U-shaped cut-out **1350** can be made in the lower region, for example along one row of openings **354** as they transition from the vertical to the horizontal. In this way, the lower region **348** is provided with a central flap **1352** or support region at the sacral region of the user's back, which is spaced from a firmer lower portion **1356**. The back member is then inserted into a mold, wherein a hinge portion **1354** is overmolded on the back member over the cut-out so as to flexibly connect the flap **1352** with the lower portion **1356** of the back member. In one embodiment, the hinge **1354** is formed as a living hinge, with a bellows shape. Of course, it should be understood that the hinge can be in-molded in the original back member, which thereby avoids the cutting and overmolding operations. In addition, it should be understood that the back member can be provided with greater flexibility by providing a thinner material in certain regions, or by providing other hinge type devices, not limited to a living hinge or molded hinges. In this way, the flap portion **1352** of the lower region **348** of the back member being acted upon by the support arm **1316** of the first support member is provided with greater flexibility to move in response to the position of the support member **1302** as the fulcrum member is moved to a desired position. In one embodiment, the hinge is formed from an elastomeric material, such as a thermoplastic elastomer.

The configuration of the spine **324** and back member **302** provides many advantages. For example, the compliant back member **302**, with its larger, or longer, openings in the lumbar region, and its lesser thickness along the center portion, allow that region to be more flexible, such that it can be formed and supported by the lumbar support and/or sacral support. In addition, the entire back is allowed to conform to the back of the user, and in particular at the edge portions thereof, and can flex about the center spine in

torsion, which is made more flexible by way of the two-piece construction with nested fins, and also about the bowed lumbar region. In essence, the intelligence of the backrest is shared by the spine **324** and the back member **302**. In this way, the backrest provides greater comfort than a backrest formed with a peripheral, and relatively stiff or non-compliant, frame. In addition, by securing the back member **302** to the arms of the spine at a location spaced below the top of the back **336**, including at about 14 inches in one embodiment, and preferably between about 2 inches and about 12 inches, and more preferably between about 4 inches and about 8 inches, the top peripheral portion can flex in response to movement from the user's shoulder and neck and further avoids a "hammock" effect between the top and bottom of the backrest.

In addition, the spine member is in essence modular, or provides a mounting configuration, which allows the manufacturer to install various support configurations on the same spine. In this way, for example, different back supports can be configured to mount on the same spine to provide an adjustable lumbar support, or a lumbar support with an adjustable sacral support. Of course, other adjustment configurations would be suitable.

Although the present invention has been described with reference to preferred embodiments, those skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention. As such, it is intended that the foregoing detailed description be regarded as illustrative rather than limiting and that it is the appended claims, including all equivalents thereof, which are intended to define the scope of the invention.